Faculty Working Papers

THE DETERMINANTS OF HOME BUYING IN THE NEW JERSEY GRADUATED WORK INCENTIVE EXPERIMENT

Dale J. Poirier

#221

College of Commerce and Business Administration
University of Illinois at Urbana-Champaign

FACULTY WORKING PAPERS

College of Commerce and Business Administration

University of Illinois at Urbana-Champaign

December 2, 1974

THE DETERMINANTS OF HOME BUYING IN THE NEW JERSEY GRADUATED WORK INCENTIVE EXPERIMENT

Dale J. Poirier

#221

The Determinants of Home Buying in the New Jersey Graduated Work Incentive Experiment

Dale J. Poirier*
September 1974

1. Introduction

The purpose of this study is to investigate home buying during the New Jersey Graduated Work Incentive Experiment. The importance of such an analysis appears to be at least five-fold.

First, Wooldridge [9] in a detailed and thought-provoking analysis of many different housing issues, and Nicholson [5] in a somewhat less detailed analysis, both reached the conclusion that there existed a definite experimental effect on homeownership. Specifically, Wooldridge's analysis found that experimentals who were over-breakeven at pre-enrollment bought homes at a statistically higher rate (about 5%) than their control counterparts by the end of the experiment. Since the over-breakeven experimentals were eligible to receive payments if their incomes dropped sufficiently, the explanation put forth by Wooldridge was that the guaranteed income gave this group the "financial security" to purchase homes,"... not only in their own eyes, but in the eyes of potential lending agencies."[1] While this latter supply side explanation does not seem consistent with finding an experimental effect at the end of the experiment, this supposingly non-payment experimental effect is interesting enough in its own right to receive added attention.[2] Furthermore, since home buying by experimentals

a costless (for the administrators of the experiment) treatment, its validity should be rigorously investigated.

Second, the results of the entire experiment are subject to the criticism that they reflect responses to a temporary three year experiment which differ from those that would be observed in a permanent national plan. As Metcalf and Nicholson [3, p. 1] point out:

> "... many methodological approaches to analyzing the effects of a negative income tax view households as making coordinated decisions regarding labor-force behavior, consumption behavior, and asset accumulation. Evidence that households view experimental payments as a transitory income source would therefore be an important indicator that the labor supply effects of a permanent income maintenance program may not correspond to observed behavior during the experimental."

Similarly, evidence that households view payments as a permanent income source would give additional credibility to the validity of labor supply results for a permanent national plan. There appears to be near unanimous agreement that home buying is a function of "normal" or "permanent" income rather than transitory income.[3] Hence, increased home buying among experimental families receiving payments would support the belief that experimental families viewed the payments as "permanent."[4]

Third, any strong positive experimental effect among nonwhites compared to whites may help to reduce limitations on homeownership found among nonwhites as a result of discrimination. As Kain and Quigley [2, p. 273] have noted, "Homeownership is clearly the most important method of wealth accumulation used by low- and middle-income families in the postwar period." Furthermore, they go on to estimate that "... an effective limitation on homeownership can increase Negro housing costs by over 30 per cent, assuming no price appreciation."

Fourth, for both whites and nonwhites, low homeownership rates imply ineligibility from favorable treatment accorded homeowners under federal income tax laws.[5] To the extent that experimentals can increase their home buying, they can become eligible for substantial savings in tax breaks.

Fifth, regardless of experimental questions, the panel nature of the data permits a more sophisticated analysis of home buying than is normally possible with cross-sectional studies due to the availability of a "normal" income variable.

In light of these considerations, the claimed experimental effect on home buying is critically investigated in the remainder of this study. The plan of attack is as follows. Section 2 discusses the selection of the "appropriate" sample (which incidently differs markedly from the one used by Wooldridge [9]. Section 3 then outlines the probit model used in the analysis, leaving to section 4 a description of the independent variables. Empirical results are contained in section 5 and section 6 attempts to reconcile them with previous studies.

2. Sample Selection

The selection of the sample in this study is crucially important. Wooldridge [9] used a sample of 776 families, each observed at pre-enrollment and quarters four, eight, and twelve. Nicholson's [5] sample consisted of 750 families each observed at quarters four, six, eight, and twelve. The present sample differs from both of these in two important aspects. First, attention is restricted to the "continuous sample" of 693 families which has formed the basis of many of the analyses of the experiment. This restriction allows for the use of the normal income variable constructed by Watts [8]. Second, and more importantly, attention is restricted to

only those families who moved (257) or those who changed their tenure status without moving (16). This atter group consists of families who apparently bought the house they had been renting. The reasons for restricting attention to only those families who changed their housing status are multi-fold:

(1) With regard to differences in ethnicity, Kain and Quigley [2, p. 265] remark: "There are some indications that the barriers to Negro occupancy in white neighborhoods are gradually declining. Thus, it could be argued that current ownership patterns primarily reflect historical discrimination and provide a misleading view of current conditions."

(2) In addition Kain and Quigley [2, pp. 265-6] go on to argue: "Because of past discrimination, Negro movers are less likely than white movers to have been homeowners in the past. This is important because when homeowners change their residence they are more likely to buy than to rent and, conversely, when renters move they are more likely to move from one rental property to another."

(3) Along the same lines, current home-buying opportunities may not differ across sites by as much as the historically-influenced pre-enrollment differences found by Wooldridge [9, pp. 5-7]. Specifically, pre-enrollment homeownership rates for Trenton, Paterson-Passaic, Jersey City, and Scranton were 19.7, 5.5, 6.0, and 29.3 per cent, respectively, for Wooldridge's sample.

(4) Even more pertinent to the analysis of possible experimental effects on home buying, it seems irrelevant to study experimentals (or for that fact controls) who never moved or changed their housing status during the experiment. Rather, the appropriate sample in which to

look for experimental effects on home buying is one limited only to potential home buyers. By using samples such as Wooldridge's or Nicholson's, experimental home purchasing effects could be mistakingly confused with other experimental effects such as the ability of experimentals to retain the homes they already live in at a higher rate than their control counterparts.

For these reasons this study focuses attention solely on the conditional probability of buying a home given a move or change in tenure status. This permits uncovering an experimental effect on home buying over an above a simple experimental effect on mobility. Indeed, since an improvement in housing made by moving into a "better" rental unit is a much lower cost action than buying a house, it is a more likely candidate in which to find an experimental effect due to a three year negative income tax experiment.

A detailed description of the 273 observations comprising the sample is provided in the Appendix. Table A1, A3, and A5 break down this sample according to ethnicity, experimental status, site, and year. Tables A2, A4, and A6 give the same breakdown for the 80 observations corresponding to home buyers. Because quarterly housing data is not available on a regular basis, the base time period is a year.

Very briefly the importance of these tables lies in the raw experimental-control differentials in probabilities of home buying contained therein. Specifically, experimental advantages of .2687 vs .1765 and .4462 vs .3793 for whites and blacks, respectively, and a control advantage of .2500 vs. .1622 for Spanish-speakers. Thus while the positive experimental effect found by Wooldridge [9] and Nicholson [5] seems evident

for whites and blacks, the exact opposite seems to be the case for Spanish-speakers. Furthermore, pro.ounced ethnic dif.erences are apparent in levels as well as in differentials. This is not surprising in light of the numerous ethnic differences which have been noted elsewhere in analyses of the experiment. however, the studies of both Wooldridge and Nicholson allow for ethnic differences only through simple intercept dummies. In contrast the analysis of Section 5 will deal with ethnic differences by a complete depooling of whites, blacks, and Spanish-speakers. Analysis will then proceed to determine whether each of these differences can be explained by factors other than those of the experiment.

3. Probit Model

Let $y_j (j = 1, 2,\ldots,n)$ be a binary variable indicating whether the jth family purchased a home ($y_j = 1$) or did not purchase a home ($y_j = 0$). Let $x_j = [x_{j1}, x_{j2},\ldots, x_{jk}]$ $(j = 1, 2,\ldots,n)(k < n)$ be a row vector of socio-economic-experimental variables pertinent to making this purchase decision, let $\beta = [\beta_1, \beta_2,\ldots, \beta_k]'$ be the corresponding column vector of coefficients, and let I_j be an index for the jth family which is a linear function of the regressors, i.e., $I_j = x_j\beta$ $(j = 1,2,\ldots,n)$. The probit model used in this study postulates the existence of standard normal random variables $I_j^* (j = 1, 2,\ldots,n)$ such that the home purchasing decision can be described by

$$y_j = \begin{cases} 1, \text{ if } I_j^* \leq I_j \\ 0, \text{ if } I_j^* > I_j \end{cases} \quad (j = 1, 2,\ldots, n).$$

In this context the decision of the jth family to buy a home is assumed to be a function of the regressors (with the index I_j) and of the random variable I_j^* which serves as a disturbance term.

Denoting by F(z) the value of the standard normal cumulative distribution evaluated at z, the probability of the jth family buying a home is Prob $\{y_j = 1|I_j\}$ = Prob $\{I_j^* \leq I_j|I_j\} = F(I_j)$, and the probability of not buying Prob $\{y_j = 0|I_j\}$ = Prob $\{I_j^* > I_j|I_j\} = 1-F(I_j)$. Assuming independence among family decisions, and ordering the sample so that the first m observations correspond to families who bought, and the remaining n - m observations to those who did not buy, the log-likelihood of the sample is[6]

$$L = \ell nL = \sum_{j=1}^{m} \ell nF(I_j) + \sum_{j=m+1}^{n} \ell n[1 - F(I_j)]$$

Setting the derivatives of (1) with respect to $\beta_1, \beta_2, \ldots, \beta_k$ equal to zero yields nonlinear normal equations whose solution is the maximum likelihood (ML) estimator $\hat{\beta} = [\hat{\beta}_1, \hat{\beta}_2, \ldots, \hat{\beta}_k]'$. The ML estimator $\hat{\beta}$ is consistent, asymptotically efficient, and has an asymptotic normal distribution with mean β and a variance-covariance matrix which can be approximated by

$$\left[\frac{\partial^2 L}{\partial\beta\partial\beta'}\right]^{-1}_{\beta=\hat{\beta}} .$$

4. Independent Variable Selection

The row vector x_j of independent variables for the jth family can be conveniently partitioned into socio-economic-demographic variables which affect the decision of all families in buying a home, and into "treatment"

variables which affect only the experiment group. With regard to the first set, the following variables (besides a constant) form the basis for the subsequent analysis.

First and foremost, average normal family income (in thousands of dollars) for the year in which the move occurred is included as a regressor.[7] As indicated in Section 1, economic theory clearly implies that a normal income type of variable should be used instead of a transitory income variable. Furthermore, unlike current income, normal income has been purged of any experimental effect.[8] Normal income is expected to have a strong positive effect on the probability of purchasing a home, and because of the way it was constructed, its effect may "swamp" that of many other non-experimental variables.[9]

Besides normal income (which includes non-work-conditioned unearned income), work-condition unearned income (measured in thousands of dollars) is also included as an earnings regressor. This permits explicit recognition of welfare payments which often have been neglected in other studies. Since welfare status may indeed reflect a treatment effect, especially among experimentals on the least generous plans, an additional regressor is included which interacts welfare payments with an experimental dummy.

Second, the prior tenure of the family is accounted for by the inclusion of dummies for families living in public housing and for families who own homes. To the extent that public housing is the least desirable tenure status, a family living in public housing would seem less likely to "jump" all the way up to the highest level of tenure status, namely homeownership than a private rental family. By the same token, an argument along the lines of Kain and Quigley to be mentioned in section 2, indicates that once a family owns and then moves, it is likely to buy again. However, considering

the low income levels of the sample, it could be that once a family owns a house they have in a sense reached he apex of their lifetime housing consumption curve, and hence they are unlikely to move unless it is a forced move - possibly due to mortgage foreclosure.[10] While this latter hypothesis cannot be tested directly, it is a possible explanation for failing to observe a significantly positive effect of prior ownership such as found by Kain and Quigley [2, pp. 266-7].

Third, as in most homeownership studies, family life cycle variables are included. These include the number of kids between the ages 6 and 15, the number of family members other than the head, spouse, and kids ages 6-15, and the head's age. Kids ages 6-15 are expected to exert a positive influence on the probability of purchase since it is during this school age period that their presence necessitates larger housing space, expecially additional bedrooms. Pre-school children are much easier to accomodate (e.g., by sharing of bedrooms with many other people), especially infants. An increase in the number of other family members is also likely to have a positive effect on the probability of purchase, albeit, to a lesser degree. The effect of the head's age, over and above its influence on income, is expected to be positive, however, its influence is not expected to be as great as that found in other studies because of the inclusion of normal income.

Fourth, in the face of the large differences in current homeownership patterns across sites noted in section 2, dummy variables are included for Paterson-Passaic, Jersey City, and Scranton. A priori it seems that site along with ethnicity is a legitimate criterion to consider for depooling. Unfortunately, small sample sizes raise problems, and hence only one case can be considered, namely whites in Scranton.

Fifth, mortgage rate and calendar time are included as regressors. The mortgage rate series used is the FHLBB effective rate on existing homes which reflects fees and charges as well as contract rates, and assumes prepayment at the end of ten years. The data were taken from Federal Reserve Bulletins (December, 1968 thru January, 1973), and the actual rate used was the average of the two middle months in the year in which the family moved. The rationale for the inclusion of the mortgage rate is as an indicator of the cost of buying a home, as well as an indicator of supply side effects. Calendar time is used to capture trends in homebuying and to take into account differences in market conditions facing families moving at different times. The actual values used for mortgage rates and calendar time are given in Tables A7 and A8.

With regard to treatment variables the following regressors are used: an experimental dummy (equalling one for an experimental family), yearly experimental payments (measured in thousands of dollars), experimental time (equalling the midyear points .5, 1.5, and 2.5 respectively, for each of the three years), and two experimental interactions, one with the head's age and one with work-conditioned unearned income. The use of experimental payments provides a simple parsimonius representation of the treatment which differentiates not only between experimentals and controls, but also between experimentals receiving payments and those who are over breakeven.[11] Because of the often fruitless results that have been encountered with explicit tax and guarantee representations, as well as their failure to identify experimentals not receiving payments, the payments approach has been adopted.

Experimental time is included in order to determine whether any possible experiment effect may tend to occur at say the end of the experiment as

Wooldridge [9] found. As mentioned earlier the experimental interaction with work-conditioned unearned inco.e is intended to capture any experimental effects which may arise through welfare status. The experimertal interaction with the head's age permits experimental families that are farther along in their life cycle of consumption (and possibly having additional assets) to react differently than families with younger heads and which may just be starting out. Indeed the youthfulness of the sample indicates that many families will be just entering into the home buying age bracket, and hence experimental-age interactions are possible.

5. Empirical Results

In light of the ethnic differences noted earlier, the decision to estimate each ethnicity separately was first tested. A pooled model with the eighteen variables described in section 4 was estimated and yielded a log-likelihood value of -132.5. Then separate models were estimated for each ethnicity yielding the log-liklihood values given in Table 2. The Scranton dummy was omitted f-om the black and Spanish-speaking models because there were no families in Scranton. Furthermore, the prior owner dummy was omitted from the Spanish-speaking model because neither of the two prior owners in the sample bought a home -- implying that its coefficient cannot be estimated (see Poirier [6]). The explanatory power of the additional thirty-one variables in the black and Spanish-speaking models was then tested by computing -2 times the increase in the log-likelihood. This yielded a test statistic of $\lambda = 66.60$ which is significant at the one per cent level. Thus the decision to depool the ethnicities appears to be consistent with the sample information.[13]

Table 1

Probit Coefficients with Standard Erros in Parentheses

Coefficient	Variable	Whites	Blacks	Spanish-speakers
$\hat{\beta}_1$	Constant	1.420 (6.533)	-21.76*** (6.878)	-4.611 (15.08)
$\hat{\beta}_2$	Normal income	.1247* (.07002)	.2640*** (.08682)	.5606** (.2341)
$\hat{\beta}_3$	Work-conditioned income	-.8584** (.3750)	-.3687 (.2669)	-.2412 (.2763)
$\hat{\beta}_4$	Prior owner dummy	.3974 (.6611)	.4688 (.7269)	- - -
$\hat{\beta}_5$	Public housing dummy	-.1870 (.4528)	-.05026 .4123	1.041 (1.223)
$\hat{\beta}_6$	Number of kids ages 6-15	.2375 (.1483)	.1784 (.1088)	.1506 (.2697)
$\hat{\beta}_7$	Family size - 2 - kids 6-15	.2712 (.1935)	-.1658 (.1345)	.1872 (.3320)
$\hat{\beta}_8$	Head's age	-.09260*** (.03370)	.08018** .03952	.03424 (.06682)
$\hat{\beta}_9$	Paterson-Passaid dummy	-.4319 (.9066)	-1.569** (.6966)	-2.568 (2.184)
$\hat{\beta}_{10}$	Jersey City dummy	-1.676 (1.259)	-2.121*** (.8220)	-1.506 (2.070)
$\hat{\beta}_{11}$	Scranton dummy	-.5992 (1.079)	- - -	- - -
$\hat{\beta}_{12}$	Calender time	-.03378 (.04144)	.1149*** .04351	.007431 (.06034)
$\hat{\beta}_{13}$	Mortgage rate	.2252 (.7609)	1.930*** (.7396)	.007213 (1.853)
$\hat{\beta}_{14}$	Experimental dummy	-4.867** (2.004)	4.172** 2.014	-11.94 (8.216)
$\hat{\beta}_{15}$	Experimental payments	.1483 (.1873)	-.1034 (.1810)	-2.161* (1.233)
$\hat{\beta}_{16}$	Experimental time	.2306 (.4600)	-1.332*** (.5189)	.1666 (.8636)
$\hat{\beta}_{17}$	(Experimental dummy) *(Head's age)	.09867** (.04434)	-.04768 (.04691)	.3062 (.1874)
$\hat{\beta}_{18}$	(Experimental dummy) *(Work-conditioned income)	.5121 (.4214)	.2873 (.3220)	-3.256 (2.541)

[a] Throughout this study "***," "**," and "*" will denote significance at the one, five, and ten percent levels, respectively.

Table 2

Probit Statistics

Statistic	Description	Whites	Blacks	Spanish-speakers
n	Sample size	118	94	61
m	Number of buyers	27	40	12
k-1	Degrees of freedom	17	16	15
L	Log-likelihood	-42.41	-42.37	-14.45
λ	-2* (log-likelihood ratio)	42.10***	43.48***	31.58***

Table 3

Likelihood Ratio Tests

Test Number	Description	Whites	Blacks	Spanish-speakers
1	Work-conditioned income ($\beta_3 = \beta_{18} = 0$)	9.394***	1.935	6.893**
2	Prior tenure ($\beta_4 = \beta_5 = 0$)	.5770	.4862	- - -
3	Family characteristics ($\beta_6 = \beta_7 = \beta_8 = 0$)	13.41***	11.56***	2.539
4	Head's age ($\beta_8 = \beta_{17} = 0$)	10.33***	5.901*	8.446**
5	Site ($\beta_9 = \beta_{10} = \beta_{11}$)	2.840	7.870**	4.233
6	Calender time and mortgage rate ($\beta_{12} = \beta_{13} = 0$)	1.783	11.83***	.02180
7	Experimental variable ($\beta_{14} = \beta_{15} = \ldots = \beta_{18} = 0$)	9.232	10.85*	9.827*
8	Experimental interactions ($\beta_{17} = \beta_{18} = 0$)	7.734**	1.69	6.758**

The probit coefficients for each of the three ethnic models are presented in Table 1. Standard statistics are given in Table 2, and the liklihood ratio tests for various groups of independent variables are given in Table 3. Considering these tables the following remarks seem in order.

With regard to earnings, as expected, normal income is significant and positive in all three models, albeit, to a lesser degree in the case of whites. Work-conditioned unearned income is consistently negative (and significant in the case of whites), most likely reflecting the fact that families with sizeable welfare payments have few assets and are probably unlikely to be able to get a mortgage. Furthermore, there is little evidence that the response for experimentals to work-conditioned unearned income differs from that of controls, although in the case of whites and blacks it tends to lessen the previously mentioned negative response. For Spanish-speakers the experimental response reinforces the negative response and the joint effect is significant(see Test 1 in Table 3).

Prior tenure status has virtually no effect on the home buying decision for any of the ethnicities (see Test 2 in Table 3). This result is somewhat surprising since besides the rationale for its inclusion presented in section 4, prior tenure was thought to be an excellent proxy for assets. As Kain and Quigley [2, p. 269] note, "For most households, black and white, equity in owner-occupied housing is itself the largest component of net worth."

Family characteristics are significant for whites and blacks, but not for Spanish-speakers (see Test 3 in Table 3). As expected the number of kids ages 6-15 has a consistent positive effect although it is not

quite significant at the 10% level. The same holds for family size except that its effect is negative for blacks. The coefficient of the head's age has the expected sign for blacks and Spanish-speakers (significant for blacks), however, it is negative and significant for whites. The "explanation" for this seems to lie in the youthfulness of the controls who bought (see Table 4). Interestingly, the experimental response interacts positively (and significantly) with the head's age for whites and in effect wipes out the significant negative effect for controls. For all three models the joint effect of the head's age is significant (see Test 4 in Table 3).

Surprisingly, site is significant only for blacks,(see Test 5 in Table 3), although Trenton (the omitted site) consistently fares better in all three models. As mentioned in section 2, the historic differences in homeownership rates across sites do not seem indicative of the housing markets during the experiment.

Calendar time and the mortgage rate are significant determinants of the home buying decision only in the case of blacks (see Test 6 in Table 3). The consistently positive coefficient for the mortgage rate seems to indicate that what is being measured is not effect of a housing "price" but rather other effects which are correlated with movements in interest rates.

Of course the independent variables of primary interest are the experimental variables. The joint test on all experimental variables (Test 7 in Table 3) indicates that there is a slight experimental effect for all ethnicities (the test for whites just misses being significant at the 10 per cent level). However, the nature of this response differs markedly across ethnicities. The weakest response is for whites and the experimental-age interaction accounts for a great deal of it. While experimental payments

Table 4

Head's Average Age

Group	Whites	Blacks	Spanish-speakers
Controls	40.33	35.89	35.47
Buyers	33.05	39.82	39.82
Non-buyers	41.89	33.49	34.02
Experimentals	35.30	35.02	37.63
Buyers	36.38	36.46	42.48
Non-buyers	34.91	33.87	36.69

Table 5

Summary of Predicted Probabilities

	Whites	Blacks	Spanish-speakers
Average for non-buyers	.1517	.2638	.09451
Average for buyers	.4806	.6521	.6117
Using independent variable means	.1362	.1966	.2007

are not significant, their positive sign, together with the negative and statistically significant dummy coefficient, indicates that experimentals near their breakeven point have a negative response. In fact for a mean-aged white experimental midway through the experiment who is receiving no work-conditioned unearned income, the estimated experimental response does not become positive until payments reach $7000.

In the case of blacks the experimental response is significant and positive for those receiving little or not payments. Specifically, for a mean-aged black experimental midway through the experiment who is not receiving work-conditioned unearned income, the estimated response is positive up to a payments level of $4877. This somewhat strange response -- positive for those not receiving payments -- is similar to that found by Wooldridge [9]. However, the negative and experimental coefficient of experimental time indicates that the greatest response occurred at the beginning of the experiment. This is consistent with the argument that the experiment provided security for over-breakeven experimentals to buy a home early in the year. As pointed out earlier, Wooldridge [9], somewhat confusingly, found this security effect setting in at the end of the experiment.

The experimental response for Spanish-speakers is different from that of both whites and blacks. The coefficient of the experimental dummy is negative, and the payments coefficient is not only negative and significant, but its absolute value is much larger than that for either whites or blacks. The implication is that experimentals not receiving payments had a negative response and this response became more negative as payments increased. The evidence clearly indicates that a negative response was present for

Spanish-speakers.

Looking deeper, a few more insights into the experimental responses can be found. In the case of blacks and Spanish-speakers (both of which had negative responses to payments), the payments coefficient is significantly different (at the 5 per cent level) from the normal income coefficient. In the case of whites (for which the payments coefficient is positive), it is virtually the same as the normal income coefficient.

Considering Table 5, the ratio of average predicted probabilities of buyers to non-buyers is greatest for Spanish-speakers (over 6 to 1) and less for whites (about 3 to 1) and blacks (about 2½ to 1). Considering Table 6, the average predicted probabilities among buyers are nearly identical for experimentals and controls in all three models. However, among non-buyers the experimental-control averages do differ somewhat. Further breaking down these averages by site results in rather eradic patterns.

Finally, two subgroups of special interest were further analyzed and they yielded the results presented in Tables A9 - A12. The first subgroup was formed by deleting those black families who bought the house they were renting. This amounted to a comparatively large eleven families (versus four for whites, and one for Spanish-speakers). The major differences in the results from subgroup (mover) model from the model considered earlier are that site, calendar time, and the mortgage rate are no longer significant. The explanation for this is somewhat elusive, but it may point out a data artifact in these observations. The experimental response is basically the same as noted for the black model in this section except that experimental time is no longer significant and the age-experimental interaction now is.

The second subgroup consists of only those whites in Scranton. This is the only subgroup large enough to permit depooling by both site and ethnicity.

Table 6

Breakdown of Average Predicted Probabilities

	Non-buyers		Buyers	
	Controls	Experimentals	Controls	Experimentals
Whites	.1122	.1856	.4730	.4844
Trenton				
mean	- - -	.3817	- - -	.6194
number	0	2	0	2
Paterson-Passaic				
mean	- - -	.4006	.5529	.5491
number	0	8	1	6
Jersey City				
mean	.2113	.1505	.0461	- - -
number	3	4	1	0
Scranton				
mean	.1046	.1293	.5226	.4185
number	39	35	7	10
Blacks	.2289	.2812	.6406	.6564
Trenton				
mean	.3358	.3627	.5943	.6574
number	5	4	5	3
Paterson-Passaic				
mean	.2811	.2265	.9085	.6646
number	2	1	2	8
Jersey City				
mean	.1708	.2943	.5646	.6526
number	11	21	4	18
Spanish-speakers	.1252	.07670	.6116	.6119
Trenton				
mean	- - -	.0662	- - -	.5659
number	0	6	0	1
Paterson-Passaic				
mean	.0814	.0763	.3140	.6919
number	5	14	1	3
Jersey City				
mean	.1421	.0828	.6711	.5149
number	13	11	5	2

As noted earlier, historical housing patterns might suggest strong differences across sites. However, as Test 5 in Table 3 suggests, there is little difference between the Scranton-only model and the white model considered earlier. The main difference is that the experimental response is slightly stronger and the payment coefficient is now significant at the 10 per cent level. The nature of this response remains the same.

6. Conclusion

The results of this study are markedly different from those found in the studies of Wooldridge [9] and Nicholson [5]. The experimental response appears fairly weak and its sign varies substantially across ethnicities. Only in the case of blacks does there appear to be evidence of a possible experimental effect among experimentals receiving small or zero amounts of payments (e.g., those over-breakeven). Unlike black experimental responses that have been found in other areas of analysis, this result does not appear to reflect a poor performance on the part of black controls. Even after excluding the five black controls who bought their own homes, the home buying rate among black controls was .2500, which is substantially larger than the rates for white or Spanish-speaking controls. While the exact explanation for these divergent results between studies is not certain, a number of possible candidates exist.

First, it seems that part of the explanation must lie in differences in the various samples used. Both Wooldridge's and Nicholson's results most likely contain at least some experimental mobility effect. For the sample used here, a mobility effect appears present only for blacks. The proportion of experimentals for whites, blacks, and Spanish-speakers are .5678, .6915, and .6066, respectively, compared to the corresponding

proportions .5839, .6453, and .6242 in the parent continuous 693 sample. It seems that Nicholson in some sense captures the spirit of the sample selection procedure used here, by using a pre-enrollment homeownership dummy. Since homeowners are less inclined to move, this dummy helps to distinguish the effects of the mover part of the sample. Also along the lines of sample selection, the ethnic pooling used by both Wooldridge and Nicholson in the face of the repeatedly large ethnic differences found in other analyses, notably in the area of consumption (see Metcalf and Nicholson [3]), must be an important factor.

Second the estimation techniques vary across studies Nicholson uses the ordinary least squares linear probability model exclusively, and Wooldridge uses both probit analysis and the former. This author's choice to use probit analysis exclusively is based on the well-known inappropriateness of the linear probability model for a model with a binary dependent variable. One important distinction between these two models is that the probit model is interactive, whereas the linear probability model is additive. For the probit model, $\frac{d\hat{p}_j}{dx_{ji}} = f(x_j\hat{\beta})\hat{\beta}_i$, which clearly depends on the levels of all independent variables.

Third, all three studies suffer from some methodological problems. Wooldridge and Nicholson analyze their inherently panel data problems by running separate cross sections at different points in time. While this procedure is inefficient, it must be admitted that the use of probit analysis on panel data is a difficult question. However, if one does not object to using the linear probability model, then all the standard panel data techniques are available. As noted earlier, the sample selection utilized here eliminates (for the most part) this panel data problem.

On the other hand, the ethnic depooling used here has of course resulted in some rather small sample sizes. Whether these sample sizes are large enough to justify the use of large sample maximum likelihood properties is unclear.

Fourth and finally, some of the poorest data in the experiment is the housing and housing debt data. This has also been noted by both Wooldridge [9] and Nicholson [5]. The problems that all authors necessarily face in piecing together often contradicting information must be expected to introduce unintentional data differences -- the effects of which are unknown.

6. Appendix

Table A1

White Sample

	Trenton	Paterson-Passaic	Jersey City	Scranton	Total
First year	2	9	2	27	40
Experimentals (%)	2(1.0)	8(.89)	1(.50)	18(.67)	29(.73)
Second year	1	3	2	23	29
Experimentals (%)	1(1.0)	3(1.0)	0(0.0)	12(.52)	16(.55)
Third year	1	3	4	41	49
Experimentals (%)	1(1.0)	3(1.0)	3(.75)	15(.37)	22(.45)
Total	4	15	8	91	118
Experimentals (%)	4(1.0)	14(.93)	4(.50)	45(.49)	67(.57)

Table A2

Home-Buying Among Whites

	Trenton	Paterson-Passaic	Jersey City	Scranton	Total
First year	0	5	1	6	12
Experimentals (%)	0(0.0)	4(.80)	0(0.0)	6(1.0)	8(.89)
Second year	1	1	0	6	8
Experimentas (%)	1(1.0)	1(1.0)	0(0.0)	3(.15)	4(.67)
Third year	1	1	0	5	7
Experimentals (%)	1(1.0)	1(1.0)	0(0.0)	1(.17)	3(.38)
Total	2	7	1	17	27
Experimentals (%)	2(1.0)	6(.86)	0(0.0)	10(.59)	18(.67)

Table A7

Mortgage Rates

Year	Trenton	Paterson-Passaic	Jersey City	Scranton
1	7.49	8.05	8.265	8.43
2	8.385	8.415	8.08	7.70
3	7.60	7.67	7.64	7.44

Table A8

Calender Time

Year	Trenton	Paterson-Passaic	Jersey City	Scranton
1	7	12	16.5	19
2	19.5	24.5	29	30.5
3	31	35.5	40	43

Table A3

Black Sample

	Trenton	Paterson-Passaic	Jersey City	Total
First year	8	8	28	44
Experimentals (%)	5(.63)	7(.88)	19(.68)	31(.70)
Second year	4	6	11	22
Experimentals (%)	2(.50)	4(.67)	8(.73)	14(.64)
Third year	2	9	15	28
Experimentals	0(0.0)	8(.89)	12(.80)	20(.71)
Total	17	23	54	94
Experimentals (%)	7(.41)	19(.83)	39(.72)	65(.69)

Table A4

Home-Buying Among Blacks

	Trenton	Paterson-Passaic	Jersey City	Total
First year	3	3	10	16
Experimentals (%)	2(.67)	3(1.0)	9(.90)	14(.88)
Second year	2	5	10	17
Experimentals (%)	1(.50)	3(.60)	7(.70)	11(.65)
Third year	3	2	2	7
Experimentals (%)	0(0.0)	2(1.0)	2(1.0)	4(.57)
Total	8	10	22	40
Experimentals (%)	3(.38)	8(.80)	18(.82)	29(.73)

Table A5

Spanish-Speaking Sample

	Trenton	Paterson-Passaic	Jersey City	Total
First year	2	10	10	22
Experimentals (%)	2(1.0)	6(.60)	3(.30)	11(.50)
Second year	3	4	7	14
Experimentals (%)	3(1.0)	4(1.0)	2(.28)	9(.64)
Third year	2	9	14	25
Experimentals (%)	2(1.0)	7(.78)	8(.57)	17(.68)
Total	7	23	31	61
Experimentals (%)	7(1.0)	17(.74)	13(.42)	37(.61)

Table A6

Home-Buying Among Spanish-Speaking

	Trenton	Paterson-Passaic	Jersey City	Total
First year	1	1	2	4
Experimentals (%)	1(1.0)	1(1.0)	0(0.0)	2(.50)
Second year	0	0	3	3
Experimentals (%)	0(0.0)	0(0.0)	1(.33)	1(.33)
Third year	0	3	2	5
Experimentals (%)	0(0.0)	2(.67)	1(.50)	3(.60)
Total	1	4	7	12
Experimentals (%)	1(1.0)	3(.75)	2(.28)	6(.50)

Table A7

Mortgage Rates

Year	Trenton	Paterson-Passaic	Jersey City	Scranton
1	7.49	8.05	8.265	8.43
2	8.385	8.415	8.08	7.70
3	7.60	7.67	7.64	7.44

Table A8

Calender Time

Year	Trenton	Paterson-Passaic	Jersey City	Scranton
1	7	12	16.5	19
2	19.5	24.5	29	30.5
3	31	35.5	40	43

Table A9

Probit Coefficients With Standard Errors in Parentheses

Coefficient	Variable	Black (movers only)	Whites (Scranton only)
$\hat{\beta}_1$	Constant	-18.28** (7.174)	30.93 (23.53)
$\hat{\beta}_2$	Normal income	.3768*** (.1095)	.2335* (.1213)
$\hat{\beta}_3$	Work-conditioned income	-.2600 (.3356)	-.8594 (.6591)
$\hat{\beta}_4$	Prior owner dummy	.6489 (.7293)	.1091 (.7964)
$\hat{\beta}_5$	Public housing dummy	-.006084 (.4689)	.3324 (.6359)
$\hat{\beta}_6$	Number of kids ages 6-15	.1906 (.1318)	-.05647 (.2260)
$\hat{\beta}_7$	Family size - 2 - kids 6-15	-.1334 (.1614)	.08571 (.3228)
$\hat{\beta}_8$	Head's age	.08875** (.04518)	-.1759** (.06977)
$\hat{\beta}_9$	Paterson-Passaic dummy	-.6425 (.8057)	- - -
$\hat{\beta}_{10}$	Jersey City dummy	-1.245 (.9359)	- - -
$\hat{\beta}_{11}$	Calender time	.07206 (.05310)	-.07112 (.09586)
$\hat{\beta}_{12}$	Mortgage rate	1.311 (.7987)	-3.246 (2.777)
$\hat{\beta}_{13}$	Experimental dummy	5.944** (2.439)	-6.121* (3.538)
$\hat{\beta}_{14}$	Experimental payments	-.2941 (.2462)	.6292* (.3406)
$\hat{\beta}_{15}$	Experimental time	-.9187 (.6553)	-1.680 (1.353)
$\hat{\beta}_{16}$	(Experimental dummy) *(Head's age)	-.09630* (.05539)	.2263*** (.08233)
$\hat{\beta}_{17}$	(Experimental dummy) *(Work-conditioned income)	.2041 (.3833)	-.4888 (1.285)

Table A10

Probit Statistics

Statistic	Description	Blacks (movers only)	Whites (Scranton only)
n	Sample size	83	91
m	Number of buyers	29	17
k-1	Degrees of freedom	16	14
L	Log-likelihood	-32.26	-20.95
λ	-2* (log-likelihood ratio)	42.90***	45.74***

Table A11

Likelihood Ratio Tests

Test Number	Description	Blacks (movers only)	Whites (Scranton only)
1	Work-conditioned income ($\beta_3 = \beta_{20} = 0$)	.6446	5.591*
2	Prior tenure ($\beta_4 = \beta_5 = 0$)	.8536	3.494
3	Family characteristics ($\beta_6 = \beta_7 = \beta_8 = 0$)	9.273**	15.80***
4	Head's age ($\beta_8 = \beta_{19} = 0$)	4.618*	16.97***
5	Site ($\beta_9 = \beta_{10} = \beta_{11} = 0$)	2.112	- - -
6	Calender time and mortgage rate ($\beta_{12} = \beta_{13} = 0$)	3.754	1.677
7	Experimental variables ($\beta_{14} = \beta_{15} = \ldots = \beta_{18} = 0$)	11.58**	17.20***
8	Experimental interactions ($\beta_{17} = \beta_{18} = 0$)	3.410	11.90***

Footnotes

*The author is an Assistant Professor of Economics at the University of Illinois at Urbana-Champaign. Part of the research that went into this study was performed while the author was a Visiting Assistant Professor at the Institute for Research on Poverty in Madison, Wisconsin during the summer of 1974. He wishes to express his gratitude to Helen Lowry of the University of Illinois for her help in implementing the probit computer package used in this study. Thanks are also owed to Robert Avery, Joseph Hotz, and Harold Watts of the University of Wisconsin at Madison and Douglas Bendt and Judith Wooldridge of Mathematics Inc. for their thoughtful comments.

[1]Wooldridge [9, p.38].

[2]Further doubt is cast on any type of supply side explanation by the recent findings of Robert Avery. Avery conducted personal interviews with lending institutions in all sites and found little, if any, awareness on their part of the experiment.

[3]See for example Carliner [1], Kain and Quigby [2], Reid [7], and Morgan [4].

[4]As Metcalf and Nicholson [3, p. 5] and Reid [7, p. 11] have noted, the main proponent of the permanent income concept, Milton Friedman, has used three year income averages as proxies for permanent income implying that individuals may only have a three year time horizon.

[5]See Kain and Quigley [2, p. 273].

[6]In the models considered in this study this independence assumption may be slightly violated since a small protion of the samples appear more than once. Specifically, 16 white, 10 black, and 8 Spanish-speaking families appear more than once.

[7]In Watts [8] the natural logarithm of normal income is estimated. Here normal income itself is used. Since $\ln y \sim N(\mu,\sigma^2)$ implies $E(y) = \exp(\mu + \frac{1}{2}\sigma^2)$, the "blowing-up" procedure took into account the estimated standard deviation of a family's income from their normal income.

[8]See Watts [8].

[9]Normal income is also serving as a proxy for assets. Unfortunately, the financial asset series constructed by Metcalf and Nicholson [3] is only available at pre-enrollment and quarters two, six, and ten. Hence, for example, for a family in Trenton who bought in the second year, it is not possible to determine whether their asset figure refers to before or after they bought. This is not viewed as a major shortcoming since as Nicholson [5, pp. 13-14] notes, the average family stock holdings of stocks, bonds, and savings accounts was only $140, and that of cash was $31. The major asset for these families is their house if they own one, and prior ownership is included as an independent variable.

[10]Wooldridge [9] states that for her sample "18.8 and 24.8 per cent of moves were made because of poor conditions or condemned housing in respectively the last and penultimate moves of families (from the tenth quarterly interview)."

[11]Since the time period involved is a year, it is not even clear how to construct an 'over-breakeven' dummy except for families who were over-breakeven the entire year. Since even experimentals over-breakeven received fees for reporting their incomes (this amounted to $260 a year for the family over-breakeven the entire year) over breakeven experimentals are also differentiated from controls.

[12]Actually there were two black families in Scranton who moved. However, as has been the practice in other studies, they have been omitted from the analysis.

[13]The three possible ethnic pairwise combinations (whites and blacks, whites and Spanish-speakers, and blacks and Spanish-speakers) were also tested separately for depooling. This yielded test statistics of 38.63, 33.75, and 28.30, respectively, which are significant at the .5, 1.0, and 2.5 percent levels. Furthermore, the Bonferroni joint testing procedure indicates that the simultaneous significance level for these three tests is at most 4.0 percent.

[14]Furthermore the ethnic proportions of .4322, .3443, and .2234 for whites, blacks, and Spanish-speakers, respectively, are close to the corresponding ethnic proportions of .4473, .3377, and .2150 in the parent continuous 693 sample.

References

[1] Carliner, Geoffrey. "Determinants of Home Ownership." Madison: Institute for Research on Poverty Discussion Paper No. 169-73, 1973.

[2] Kain, John F., and John M. Quigley. "Housing Market Discrimination, Homeownership, and Savings Behavior." American Economic Review. Vol. LXII (June, 1972), 263-77.

[3] Metcalf, Charles E., and Walter E. Nicholson. "Low-Income Households and the Permanent Income Hypothesis: Implications of the Urban Experiment." Unpublished manuscript presented at a joint meeting of the American Economic Association and the Economic Society, New York, 1973.

[4] Morgan, James N. "Housing and Ability to Pay." Econometrica. Vol. XXXIII (April, 1965), 289-306.

[5] Nicholson, Walter. "Expenditure Patterns in the Graduated Work Incentive Experiment: A Descriptive Survey." Final Report of the New Jersey Graduated Work Incentive Experiment. Madison: Institute for Research on Poverty, 1973, DIIIb-1 to DIIIb-51.

[6] Poirier, Dale J. "A Note on 'Perfect Classifications' in Binary Dependent Variable Models." Unpublished manuscript, 1974.

[7] Reid, Margaret G. Housing and Income. Chicago: University of Chicago Press, 1962.

[8] Watts, Harold W. "The Estimation of Normal Family Income." Final Report of the New Jersey Graduated Work Incentive Experiement. Madison: Institute for Research on Poverty, 1973, BI-61 to BI-93.

[9] Wooldridge, Judith. "Housing Consumption in the New Jersey-Pennsylvania Experiment." Final Report of the New Jersey Graduate Work Incentive Experiment. Madison: Institute for Research on Poverty, 1973.